

AN  
INAUGURAL DISSERTATION

ON

*Anatomy and Physiology of The Kidneys*

SUBMITTED TO THE

PRESIDENT, BOARD OF TRUSTEES, AND MEDICAL FACULTY

OF THE

University of Nashville,

FOR THE DEGREE OF

DOCTOR OF MEDICINE.

BY

*Geo. W. Cox*

OF

*Tennessee*

*March* 1857

W. T. BERRY & CO.,  
BOOKSELLERS AND STATIONERS,  
NASHVILLE, TENN.

## Anatomy and Physiology of the Kidneys

The Kidneys belong to the order of glands, and are of a peculiar structure, and perform a very important office, in the animal economy.

Their office is to separate, from the blood, certain solids; and watery portions holding saline substances in solution. These glands are two in number, situated upon each side of the spinal column; between the eleventh dorsal, and third lumbar vertebra.

Their length is about four, and a half inches, their breadth two inches, and their thickness, one inch. They are of a compressed ovoid form. Their anterior surface is convex, and the

posterior, flat. The convex border is placed towards the abdominal parietis, The concave border towards the spine; and it has an excavation (*Hilum Renalis*) in which, are situated the blood vessels, nerves, and pelvis of the Kidney. They are held in situ, by cellular tissue, and blood vessels.

When we divide the Kidney longitudinally, we observe, that it is made up of two portions; an external, or vascular portion; and an internal, or Tubular portion. The external, or cortical part, is made up of blood vessels, and *Tubuli Uriniferi*. These tubes are very much convoluted, and the capillaries, and *Tubuli descendi* near the termination of the cones of

The medullary portion. In the vascular portion, we discover a vast number of very minute, red bodies.

These are made up of small capillary vessels, and a coil of uriniferous Tubes, which receive the name, of Corpora Malpighiana. These vascular tufts are invested by a membranous sack, ~~The~~ diameter, of these corpuscles of Malpighii; are about the  $\frac{1}{1000}$  of an inch. The capsule of these little bodies, is supposed to be the origin of the Tubuli uriniferi; and these tubuli spread out to join the vascular tufts.

A small vein comes out, from the inside of the Malpighian tufts, and unites with the efferent vessels, of the other bodies; so as to form a

venous plexus. The Tubular, or  
Mullary portion of the Kidney, consists  
of ten, or twelve, redish looking  
bodies, to which Anatomists give  
the name of the Pyramias of Malpighii.

Their base is towards the vascular  
portion, and their apex towards  
the hilus of the organ. The pyramias  
are made up of Tubuli Uriniferi, the  
diameters of which, are about the  
size of a hair. The Tubuli have  
their origin, at the termination of the  
pyramias of Malpighii, and in passing  
from these, towards the cortical por-  
tion, they divide, and run in a  
parallel direction; and have small  
blood vessels lying between them.

In approaching the base of the

cones, they become very tortuous, and are extremely small, in order to inosculate with the Malpighian corpuscles. The diameter, of these Tubuli Uriniferi, is about  $\frac{1}{30}$  of an inch,

These mammillary processes, that are contained in the interior, are invested by mucous membrane; and this continues with the Tubuli, and is reflected from them, so as to form a membranous sack.

The Kidneys are very abundantly supplied with blood, by the renal artery, which is given off from the aorta. If we inject the Kidney, and then macerate it, in diluted muriatic acid; we discover, that the vessels resemble

The form of the glands, in a very beautiful manner. We have two distinct systems of capillary vessels, in the kidney. The blood passes through both, in order to pass from the arteries, to the veins. The first, is that, which is formed by the vascular tuft, in which Malpighian bodies, and the second, is that which envelops the convolutions of the uriniferous tubes; and has direct communication with the veins.

The veins of the kidney, are formed by commencing at the substance of the organ; and by communicating with the veins, from other portions of the organ; thus making up the renal vein, which terminates in the

vena cava. The nerves of the Kidney, are derived from the renal plexus, which is said to be formed, partly by the solar plexus, and partly by the lesser splanchnic nerves.

Physiological functions of the Kidneys.

It is the office of the Kidneys to separate from the blood certain effluvia substances, which serve no nutritive function in the economy. This is a wise provision of nature, to adapt these organs to the performance of the important task of depurating the blood. The subject of the secretions of the Kidney, has engaged the attention of Physiologists; from time



immemorial; and many of the noble heads of our profession, have spent a greater portion of their lives, in the investigation of this subject.

The urine is composed of water, holding certain solids in solution.

The solid portions of urine, are found in a state of solution in the blood. And they are formed from an excess of nitrogenous aliment, introduced into the system. The Malpighian tufts secrete the watery portions, or they are permitted to pass through by transudation.

The solid portions are separated by the cells of the Tubuli uriniferi.

It is also stated, that it passes from the blood, without further elaboration, and the Sulphates and Phosphates,

are formed, by the <sup>chemical</sup> agency of the gland cells. The secretions of the Kidneys, are very rapid, when compared with other secretions. When there is an undue proportion of watery fluid in the blood, it is eliminated by the Kidneys, in the form of urine.

The urine is conveyed by the Tubuli, into the pelvis of the Kidney, and from thence through the ureters to the bladder. These excretory ducts are about eighteen inches in length.

The urine is of a pale yellow color. When first voided, it emits a peculiar aromatic odor, and is of an acid reaction. In order to test the acid properties of urine, we immerse blue litmus paper into it, when first

voider, and it will change its color to ~~blue~~ <sup>red</sup>. Let the urine remain until decomposition has taken place, and then immerse the red litmus paper in it and it will restore the blue color.

The urine varies in quantity, owing to the condition of the skin, or the temperature of the atmosphere. The proportion is greater in winter than in summer.

In summer the secretions of the skin are increased, and those of the kidney diminished. The amount secreted in summer is estimated at about 300g per diem, and in winter 400g. The average amount 350g. The chemical composition of urine is given differently by

different authors upon the subject,

In one thousand parts of urine,  
there are 967 parts of water, urea  
14.23, uric acid .468, coloring  
matter, and mucus combined  
10.167, Sats 8.135. The proportions  
may vary at different times. The  
water depends upon the fluid drank,  
and disease may increase or  
diminish it. In certain ner-  
vous affections it is increased,  
while in others it is diminished.

The urea is first of the solid  
constituents of the urine, and  
it forms nearly one half of  
of the solid portions of the urine.

Urea is formed in the blood,  
by the disintegration of the animal

Tissues, or an excess of nitrogenous food in the system. It is said to be increased by great muscular exertion. Urea has been detected in the blood in health; but when in excess, it produces very injurious consequences. It acts very violently upon the nervous system, producing a narcotic effect, and sometimes spasms resembling epilepsy.

Uric acid is formed from the nitrogenous elements of the food. In healthy urine, uric acid is contained in small quantities.

It is increased by animal food. When in excess in the blood, it is deposited sometimes in the joints, in the form

of urate of Soda. It also enters into the composition of urinary Calculi.

The mucus in the urine consists in the debris of the mucous surfaces of the Uriniferous Tubes.

Hippuric acid exists in the urine of Man, but not in a free state. It is said by writers to be combined with Soda, forming the hippurate of Soda.

The salts contained in the urine are derived from various sources.

They may be in abundance, owing to the administration of salts in the food; or in the way of medicine.

Among the great number of salts, enumerated by writers, I shall not attempt to explain all

their minutia; but only to give  
the most general parts in their  
formation. It is a disputed  
point in Physiology, regarding the  
nature, and peculiarities of these  
ingredients; and for me in my  
imperfect knowledge of medicine,  
to attempt, to explain scientifically,  
these minutia, would be far be-  
yond my power. They are formed  
by the wasting of the tissues of the  
body. They may be, to a certain  
extent, taken in with the food.

We have the sulphates, and  
phosphates making up certain  
portions of urine. Their for-  
mation is accounted for by  
the sulphur, and phosphorus com-

lining with the acids, contained in the urine. The Sulphur is formed by the decomposition of the nitrogenous tissues, and it by uniting with the oxygen, supplied by the lungs, forms sulphuric acid, and this combines with the substances in the urine, and forms the Sulphates.

The Phosphorus is formed by the wasting of the osseous tissues, and this uniting with the oxygen forms an acid; this acid combining with the substance in the urine, forms Phosphates. Phosphorus may be derived from another source, by the disintegration of the nervous tissues. In great mental exertion, it is said to be increased.

Jan, 6, 1857,

G. W. Case